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Front End Equipment Protection System (FE-EPS)
Interface Control Document
for the
Generation-3
Personnel Safety System
(PSS)
of the
Advanced Photon Source
at
Argonne National Laboratory
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WBS X.1.4.1.4

	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052	
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved
	Generation-3 Personnel Safety System		Date 10/04/2004	
			Page 2 of 17	

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	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052		
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved	Date 10/04/2004
			Page 4 of 17		
Generation-3 Personnel Safety System					

Table of Contents

1. INTRODUCTION.....	6
1.1. System Purpose.....	6
1.2. Definitions, acronyms, and abbreviations	6
1.3. References	7
1.4. Revision Record	8
1.5. Notes & Exceptions	9
2. SCOPE.....	10
3. APPLICABLE DOCUMENTS.....	10
3.1 APS Documents.....	10
3.2 Drawings.....	10
3.3 Precedence.....	10
4. OVERVIEW OF EQUIPMENT AND RESPONSIBILITIES.....	11
4.4 PS1 Opened	11
4.4.1 Description	11
4.4.2 Operation.....	11
4.4.3 Responsibility.....	11
4.5 PS2 Opened	11
4.5.1 Description	11
4.5.2 Operation.....	11
4.5.3 Responsibility.....	11
4.6 SS1 Opened and SS2 Opened.....	12
4.6.1 Description	12
4.6.2 Operation.....	12
4.6.3 Responsibility.....	12
4.7 PS1 Open Request	12
4.7.1 Description	12
4.7.2 Operation.....	12
4.7.3 Responsibility.....	12
4.8 FE Permit.....	13
4.8.1 Description	13
4.8.2 Operation.....	13
4.8.3 Responsibility.....	13
4.9 Related Interface Control Documents (ICDs)	13
5. INTERFACE CHARACTERISTICS.....	14
5.10 Physical Requirements	14
5.11 Mechanical Interface	15
5.11.1 Cable.....	15
5.11.2 Terminal Blocks.....	15
5.11.3 Mounting Rails	15
5.11.4 Fuses	15
5.12 Electrical/Electronic Interfaces.....	16
6. SAFETY CONSIDERATIONS.....	16

	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052		
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved	Date 10/04/2004
	Generation-3 Personnel Safety System		Page 5 of 17		


6.13	Voltage.....	16
6.14	Fail Safe.....	16
6.14.1	Wiring Diagram	17

LIST OF FIGURES

FIGURE 5-1	INTERFACE BLOCK DIAGRAM.....	14
FIGURE 0-1	INTERFACE WIRING DIAGRAM	17

LIST OF TABLES

TABLE 4-1	PSS RESPONSE TO FE-EPS SIGNALS	13
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	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052	
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved Date 10/04/2004
	Generation-3 Personnel Safety System		Page 6 of 17	

1. Introduction


1.1. System Purpose

This Chain-A input/output listing contains the hardwired addresses for the Allen Bradley Control Logix PLC. This listing will be utilized for software design and development of the Personnel Safety System (PSS).

1.2. Definitions, acronyms, and abbreviations

The following are some of the frequently appearing or unique acronyms used in this document. This list is provided as a quick reference for the reader's convenience.

ACIS	Access Control Interlock System
APS	Advanced Photon Source
ASD	Accelerator Systems Division
BLEPS	Beam Line Equipment Protection System
CPU	Central Processing Unit
C&C	Command and Control
DIW	De Ionized Water
DOE	Department Of Energy
EPICS	Experimental Physics and Industrial Control System
EPS	Equipment Protection System
ES&H	Environment, Safety & Health Manual
ESD	Emergency Shut Down
FE-EPS	Front End Equipment Protection System
FOE	First Optics Enclosure
I/O	Input Output
IOC	Input Output Controller (data collection for EPICS)
LAN	Local Area Network
OI	Operator Interface
PSS	Personnel Safety System
PLC(s)	Programmable Logic Controller
PMD	Programmable Message Display
SAD	Safety Assessment Document
SDD	Software Design Document
SyRS	System Requirements Specification
TBD	To Be Defined/Decided
VME	Versa Module Euro card
XFD	Experimental Facilities Division

	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052	
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved Date 10/04/2004
	Generation-3 Personnel Safety System		Page 7 of 17	

1.3. References

Government Documents

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

Department of Energy (DOE) ORDER 420.2A, 01-08-01
Accelerator Safety Implementation Guide for DOE O 420.2A, Draft, August 2001
DOE ORDER 5480.25, 11-3-92
DOE GUIDANCE 5480.25, September 1, 1993

DOE ORDER and GUIDANCE 5480.25 are included because they were in effect and referenced when the Safety Assessment Document (SAD) was originally written; it has been superseded by DOE ORDER 420.2, which has been superseded by DOE ORDER 420.2A. DOE ORDER 420.2(A) essentially made the approved SAD the effective regulatory document.

Copies of specifications, standards, drawings and publications required by suppliers in connection with specified procurement functions should be obtained from the contracting agency or as directed by the contracting office.

Non-Government Documents

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

Environment Safety & Health Manual, Section 5.16 (ES&H 5.16) April 25, 2003, Argonne National Laboratory.
APS Safety Assessment Document (SAD), Rev 1, May 1999, Argonne National Laboratory, Argonne, IL.

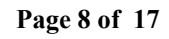
Compliance with the following required by SAD:


Stanford Linear Accelerator Center Report 327 (SLAC 327), April 1988, Stanford Linear Accelerator Center, Menlo Park, CA.

National Council on Radiation Protection Report No. 88 (NCRP 88), Issued 30 December 1986, National Council on Radiation Protection.

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal Agencies.


Document No. 1111-00001-00 APS Quality Assurance Plan, dated May 1990.

[illegible]

	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052		
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved	Date 10/04/2004
	Generation-3 Personnel Safety System		Page 9 of 17		

1.5. Notes & Exceptions

All Input Signals are High True unless otherwise noted.

	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052	
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved Date 10/04/2004
	Generation-3 Personnel Safety System		Page 10 of 17	

2. SCOPE

The main functions of the interface between the Front End Equipment Protection System (FE-EPS) and Personnel Safety System (PSS) are to protect the front end and beamline components from being damaged by synchrotron radiation.

This Interface Control Document (ICD) addresses the mechanical, electrical and operational aspects of the FE-EPS to PSS interface.

3. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein.

3.1 APS Documents

Document No. 1111-00001-00 APS Quality Assurance Plan, dated May 1990.

3.2 Drawings


PSS Distribution Panel Wiring Diagram 81-100, Drawing No. 302201-00

3.3 Precedence

In the event of conflict between the provisions of this specification and other documents, the following precedence shall apply:

This specification.

Documents referenced to the extent referenced herein.

	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052	
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved Date 10/04/2004
	Generation-3 Personnel Safety System		Page 11 of 17	

4. OVERVIEW OF EQUIPMENT AND RESPONSIBILITIES

Signal exchange between the two systems is as follows.

4.4 PS1 Opened

4.4.1 Description

The ***PS1 Opened*** signal originates in the main PSS rack. The primary purpose of this information is to protect front end devices from damage by x-rays. The status of this signal is displayed on the FE control panel and in EPICS displays.

4.4.2 Operation

The ***PS1 Opened*** signal makes known to the FE-EPS that PS1 is fully open, as monitored by the PSS Chain A. If the signal is true (1), the FE-EPS concurs that it is safe to open photon shutter 2 (PS2), provided all interlocks downstream of the PS2 are satisfied. If the signal is false (0), the FE-EPS prevents PS2 from opening.

4.4.3 Responsibility

The ***PS1 Opened*** signal from the PSS is the responsibility of the SI PSS personnel.

4.5 PS2 Opened

4.5.1 Description


The ***PS2 Opened*** signal originates in the main PSS rack. The primary purpose of this information is to protect the front end and beamline devices from damage by x-rays. The status of this signal is displayed on the FE control panel and in EPICS displays.

4.5.2 Operation

The ***PS2 Opened*** signal informs the FE-EPS that PS2 is fully open, as monitored by the PSS Chain A.

4.5.3 Responsibility

The ***PS2 Opened*** signal from the PSS is the responsibility of the SI PSS personnel.

	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052	
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved Date 10/04/2004
	Generation-3 Personnel Safety System		Page 12 of 17	

4.6 SS1 Opened and SS2 Opened

4.6.1 Description

The **SS1 Opened** and **SS2 Opened** signals originate in the main PSS rack. The primary purpose of this information is to protect safety shutters from damage by x-rays.

4.6.2 Operation

The **SS1 Opened** and **SS2 Opened** signals inform the FE-EPS that the safety shutters are fully open, as monitored by the PSS Chain A. If both signals are true (1), the FE-EPS concurs that it is safe to open PS2, provided all other interlocks downstream of the PS2 are satisfied. If any one of these signals is false (0), the FE-EPS prevents PS2 from opening.

4.6.3 Responsibility

The **SS1 Opened** and **SS2 Opened** signals from the PSS are the responsibility of the SI PSS personnel.

4.7 PS1 Open Request


4.7.1 Description

The **PS1 Open Request** signal originates in the relay rack housing FE-EPS control electronics. This signal makes known to the PSS the demand to open PS1.

4.7.2 Operation

The **PS1 Open Request** signal is true (1) whenever the equipment protection interlocks downstream of the PS1 are made up and the 'PS1 Open' push-button in the FE Control Panel or in EPICS display are depressed. PSS will then allow PS1 to open. The signal turns false (0) if PS1 is not in the full open position within 10 seconds after the command has been issued. An equipment interlock trip in the section of the FE that is between the PS1 and PS2 or pressing the 'PS1 Close' button will also make the signal false. Table 3-1 on page 10 summarizes the signals sent from the FE-EPS to PSS.

4.7.3 Responsibility

	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052	
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved Date 10/04/2004
	Generation-3 Personnel Safety System		Page 13 of 17	

The **PS1 Open Request** signal from the FE-EPS is the responsibility of the SI FE-EPS personnel.

4.8 FE Permit

4.8.1 Description

The **FE Permit** signal originates in the relay rack housing FE-EPS control electronics. This signal makes known to the PSS that all FE-EPS interlocks are satisfied.

4.8.2 Operation

When the **FE Permit** signal is true (1), PSS concurs that is safe to have all FE shutters open. Should the signal turn false (0), the PSS will immediately close PS2 and both safety shutters. PS1, however, will remain open as long as the **PS1 Open Command** signal is true. See Table 3-1 below.

4.8.3 Responsibility

The **FE Permit** signal from the FE-EPS is the responsibility of the SI FE-EPS personnel.


Table 4-1 PSS Response to FE-EPS Signals

PS1 Open Request	FE Permit	PSS Action
1	0	PS2 will close, PS1 will remain open.
0	0	PS1 and PS2 will close
1	0 or 1	PS1 will open
0 or 1	1	PS1 and PS2 will open or stay open

Note: The FE-EPS is programmed not to allow the **FE Permit** signal to be asserted on (= 1) if it is unsafe to open PS1.

4.9 Related Interface Control Documents (ICDs)

There are no related ICDs that impact this interface.

	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052	
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved Date 10/04/2004
	Generation-3 Personnel Safety System		Page 14 of 17	

5. INTERFACE CHARACTERISTICS

The interface is, mechanically, an instrumentation (tray rated) cable terminated in the FE End Rack and in the PSS main rack. Six signals are required between these racks. A block diagram of the interface is shown in Figure 4-1.

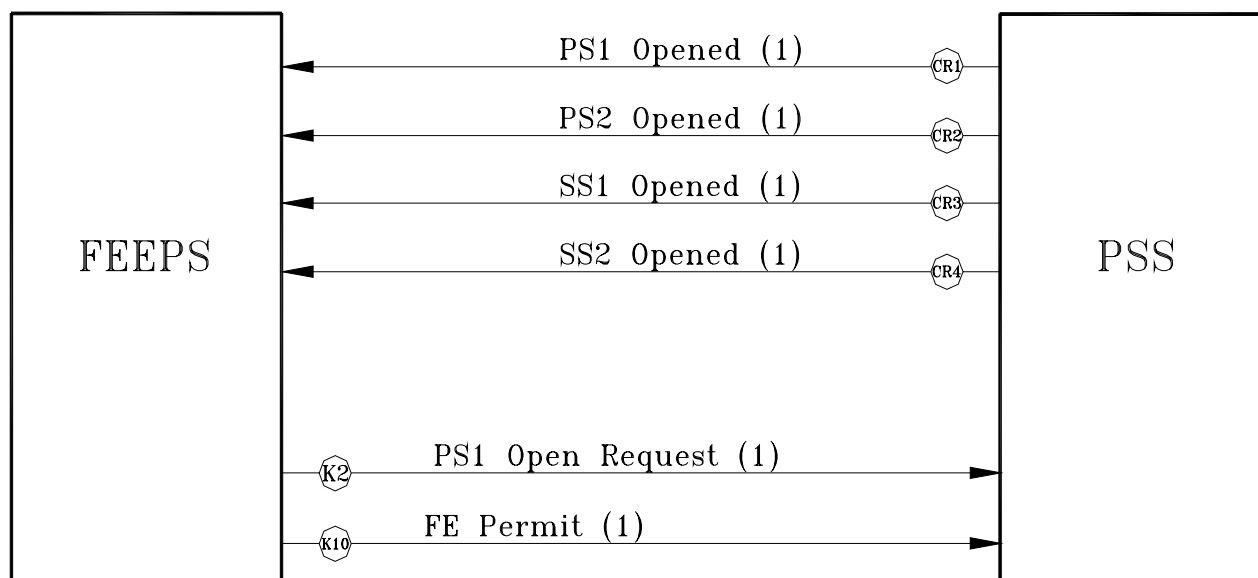



Figure 5-1 Interface Block Diagram

5.10 Physical Requirements

The physical requirements for the interface are the accessibility and identification requirements. The terminal blocks (terminal blocks) shall be placed such that there is sufficient space around them to allow access for testing and troubleshooting. The TB banks require labels be placed identifying that the TB banks are part of the FE-EPS to PSS interface. The cable requires labels be placed at both ends.

	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052	
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved Date 10/04/2004
	Generation-3 Personnel Safety System		Page 15 of 17	

5.11 Mechanical Interface

The mechanical interface is a bank of WAGO front-entry, rail-mounted terminal blocks located inside the FE End Rack and main PSS equipment rack. Devices that interface the signals between the FE-EPS and PS include terminal blocks, mounting rails, relays, fuses, and cable.

5.11.1 Cable

A multi-conductor instrumentation/process control cable shall be used for the interface. The cable is a 20 conductor, 20 AWG, overall foil shielded Alpha No. 45470/20.

Pulling the interface cable between the FE-EPS and PSS cabinets and applying the necessary labels is the responsibility of the SI FE-EPS personnel.

Terminating the cable in the FE End Rack and installing the necessary labels is the responsibility of the SI FE-EPS personnel.

Terminating the cable in the PSS rack is the responsibility of the SI PSS personnel.

Cable drain wire shall be connected to ground at the FE-EPS end only, and shall be cut off at the PSS end.

5.11.2 Terminal Blocks


A series of front-entry DIN rail mounted WAGO through terminal blocks shall be utilized to terminate the cable. The terminal blocks will be located inside the FE End Rack and main PSS rack. The FE-EPS will also use 1 WAGO Ground TB to terminate shield drain wire.

5.11.3 Mounting Rails

DIN metal mounting rails shall be used for mounting the terminal blocks and relays. The rail dimensions are 35 mm x 7.5 mm, 1 mm thick. The rails shall be perforated at the bottom. Perforation dimensions are 25 mm x 5.2 mm, with 36 mm spacing between them. The IBOCO part number for the rails is Omega 3FD.

5.11.4 Fuses

The power distribution wiring in the FE End Rack and PSS cabinet shall be fuse protected at the bus with two fuses. Both the +24VDC and DC common lines shall be fused. Fuse specifications: 3A fast-acting.

	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052	
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved Date 10/04/2004
	Generation-3 Personnel Safety System		Page 16 of 17	

5.12 Electrical/Electronic Interfaces

- a) All interface signals shall utilize +24VDC voltage level.
- b) All FE-EPS to PSS interface signals shall be relay isolated.
- c) Outputs from both systems shall drive relay coils, and the contacts of these relays shall be used as inputs by the interfacing system.
- d) The interface cable shall be protected against dead shorts to ground (even if the power supply is floating) by fusing either the individual cable or at the DC distribution bus.

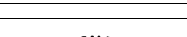
6. SAFETY CONSIDERATIONS

6.13 Voltage

Low voltage DC circuitry is used for status and control signals (+24VDC).

6.14 Fail Safe

By using normally open (NO) status switches, sets of NO relay contacts, and positive logic, 'true high', the system is inherently fail-safe to faults such as loss of power or open circuits.

	ARGONNE NATIONAL LABORATORY		Document No. 4104-913052		
	Title: Front End Equipment Protection System (FE-EPS) Interface Control Document		Rev. 00	Approved	Date 10/04/2004
	Generation-3 Personnel Safety System		Page 17 of 17		

6.14.1 Wiring Diagram

The interface shall be wired as shown in Figure 6-1 below.

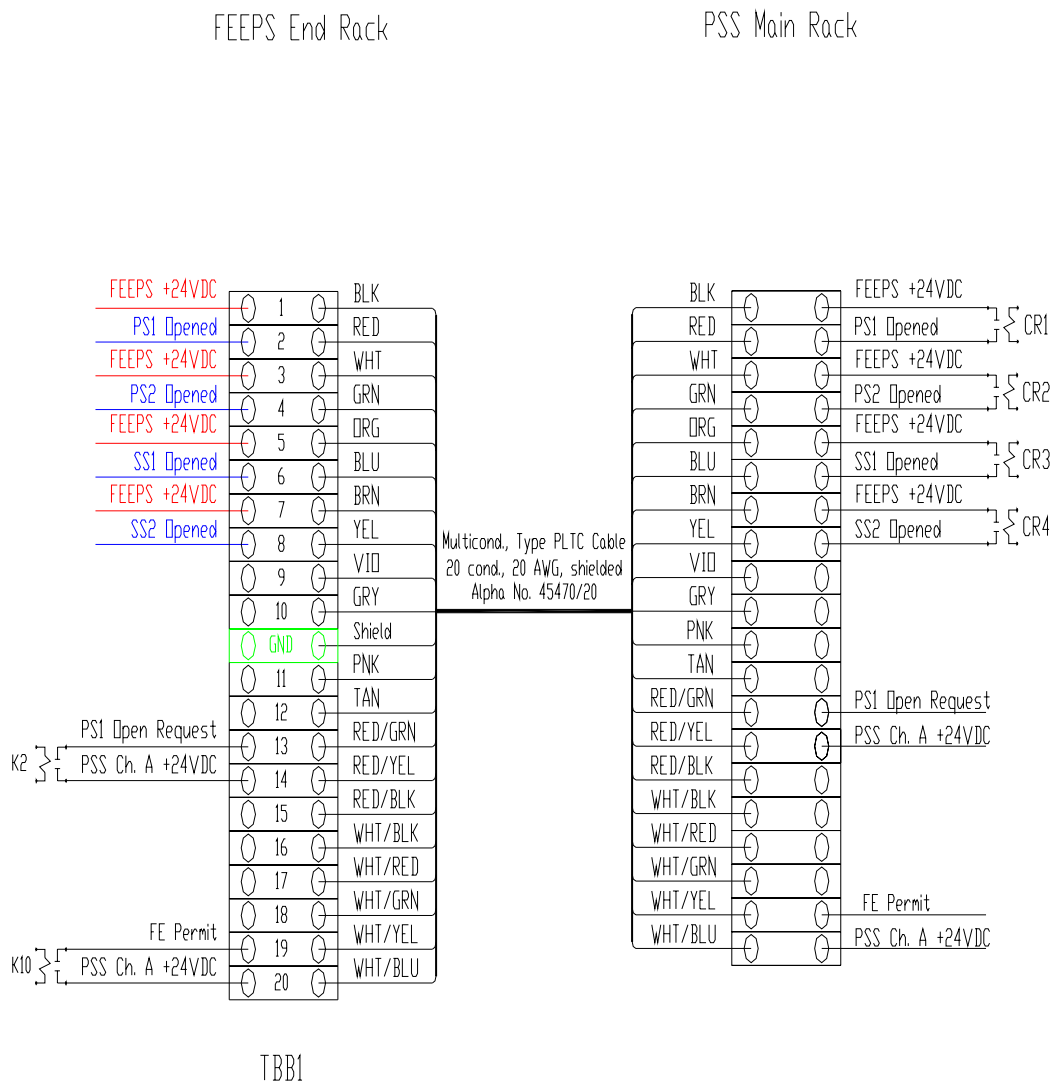


Figure 6.14.1-1 Interface Wiring Diagram